Spring 2017

Chemistry 101: Chemistry Tutorials
Faculty Mentors: Harry Gray, Mitchio Okumura, Dave Tirrell
Graduate Student Facilitators: Kelsey Boyle and Rebekah Silva
Website: http://chemweb.caltech.edu/ch101/
E-mail: caltech.chem101@gmail.com

1. **Revolutionary Inorganic Molecules**
   Dr. Allegra Liberman-Martin and Dr. William Wolf, Postdoctoral Scholars, Grubbs Group
   Ch 101 Faculty Mentor: Harry Gray
   This course will focus on the semi-chronological discovery of groundbreaking inorganic and organometallic molecules and their impact on modern chemistry. We will present the material with an emphasis on the unique properties of several classes of molecules from both the p-block and the d-block using case studies from the recent literature.

2. **Chemical Nanoscience**
   Carlos Read and Katherine Rinaldi, Graduate Students, Lewis Group
   Ch 101 Faculty Mentor: Harry Gray
   This course will focus on the chemical principles underlying the emerging fields of nanoscience and nanotechnology. Topics to be covered include how nanoscale matter differs from bulk materials, strategies for the synthesis and functionalization of nanomaterials and an overview of the tools and principles involved in their characterization. The properties and application of nanomaterials to fields of interest such as catalysis, solar energy conversion, medicine and biology, environmental remediation, optics and electronics will also be reviewed. Additionally, the known and potential effects of nanomaterials on human health and the environment will be discussed.

3. **Astrochemistry: Spectroscopy in Space**
   Cam Buzard and Olivia Wilkins, Graduate Students, Blake Group
   Ch 101 Faculty Mentor: Mitchio Okumura
   This astrochemistry tutorial will explore how chemistry exists and can be detected in different astronomical environments. Themes will include observational and laboratory techniques used to study a variety of topics, from complex organic molecules in the interstellar medium to atmospheres on faraway exoplanets and brown dwarfs. By the end of the course, students will be familiar with the breadth of astrochemistry research and some of the techniques by which it is conducted.

4. **Ultrafast Laser Spectroscopy and Microscopy**
   Dr. Mohammed Hassan, Postdoctoral Scholar, Zewail Group
   Ch 101 Faculty Mentor: Mitchio Okumura
   This course offers an introduction to the ultrafast world. It will start with an introducing to ultrafast lasers as a light source and the nonlinear process. Then, study the basic principles of Time-Resolved Laser Spectroscopy and Spectroscopic Instrumentation. Later, the Applications of Laser Spectroscopy in chemistry and biochemistry will be discussed. In addition, introducing to ultrafast electron microscopy (UEM) and its different techniques will be covered. Finally, we will discuss the different applications of UEM and its future perspectives.

Spring 2017

5. **"Curing" Cancer from a DNA Perspective: Trends in Treatment Strategies from Cisplatin to Virotherapy**
   Kelsey Boyle and Rebekah Silva, Graduate Students, Barton Group
   Ch 101 Faculty Mentor: Dave Tirrell
   In this course, we will look at cancer and cancer therapy from a DNA perspective. Starting small, we will examine the biological, chemical, and physical properties of DNA, and how these properties have influenced our understanding of DNA metabolism (repair, replication, recombination, etc.) and informed the design of cancer therapy over the last 50 years. From this perspective, we will track the evolution of cancer therapies, all the way from small molecule DNA-binders (such as the ubiquitous platinum therapeutics) to emerging immunotherapeutic strategies such as virotherapy and T-cell therapy to state-of-the-art research in cancer therapies such as CRISPR-based therapies and other selective therapies in pre-clinical and clinical trials. Throughout this course, we will examine how fundamental research has influenced the evolution of treatment strategies and how it has helped researchers develop new strategies to fight cancer.

6. **Chemical Tools in Biological Systems: A Survey of the Chemical Biology Literature**
   Sam Ho and Bryce Jarman, Graduate Students, Tirrell and Dougherty Groups
   Ch 101 Faculty Mentor: Dave Tirrell
   This course will focus on the chemical biology of proteins as it is presented in the literature. Specifically, the course will be aimed towards critically evaluating the chemical biology literature and understanding common themes, with in-class discussion playing a primary role. Each week, the instructors will interact with students, improving their ability to survey the emerging tools in chemical biology, think critically about the literature, and communicate effectively. Class will meet for 1.5 hours each week.